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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : H04Q 7/24, H04B 7/185 — A1

(11) International Publication Number: WO 96/34503

(43) International Publication Date: 31 October 1996 (31.10.96)

(21) International Application Number: PCT/GB96/00986

(22) International Filing Date: 25 April 1996 (25.04.96)

(30) Priority Data:
9508367.1 25 April 1995 (25.04.95) GB

(71) Applicants *(for all designated States except US)*: AETHOS COMMUNICATION SYSTEMS [GB/GB]; Charter House, The Square, Lower Bristol Road, Bath BA2 3BH (GB). PT PASIFIK SATELIT NUSANTARA [ID/ID]; Mulia Center, 9th floor, Room 901, Jalan HR Rasuna Said, KAV X6 No.8, Jakarta 12940 (ID).

(72) Inventor; and

(75) Inventor/Applicant *(for US only)*: SKAIFE, Richard, James [GB/GB]; Old Cann School, Salisbury Road, Shaftsbury, Dorset SP7 0BP (GB).

(74) Agent: HOGG, Jeffery, Keith; Withers & Rogers, 4 Dyer's Buildings, Holborn, London EC1N 2JT (GB).

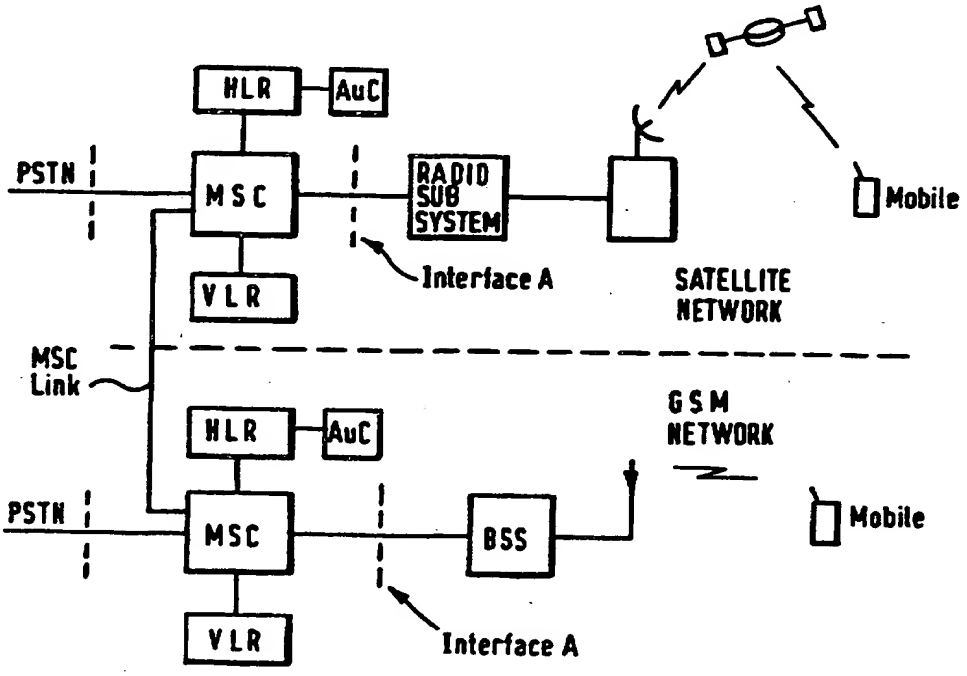
(81) Designated States: AL, AM, AT, AU, AZ, BB, BG, BR, BY, CA, CH, CN, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IS, JP, KE, KG, KP, KR, KZ, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TR, TT, UA, UG, US, UZ, VN, ARIPO patent (KE, LS, MW, SD, SZ, UG), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).

Published

With international search report.

Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: DUAL MODE MOBILE TELECOMMUNICATIONS SYSTEM



(57) Abstract

A dual mode telecommunication system is provided whereby a subscriber's mobile telephone can make and receive calls using either a terrestrial GSM network or a satellite network.

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DUAL MODE MOBILE TELECOMMUNICATIONS SYSTEM

This invention relates to radio telecommunications systems, especially mobile telecommunications systems.

GSM refers to the Global System for Mobile Communications, which has been developed as a standard for land-based telecommunications systems so that a subscriber in one system can make and receive calls using his mobile telephone when he leaves the fixed radio network of the home system and moves into the fixed radio network of a visited system.

Each system has an associated mobile switching centre MSC which operates to route calls to and from subscribers' telephones in the home system, and via the MSCs of visited systems to and from subscribers' telephones in visited systems. A Home Location Register HLR, a Visiting Location Register VLR and an Authentication Centre AuC are also associated with the MSC of each system.

Each subscriber is issued with a unique International Mobile Subscriber Identity IMSI which is incorporated in a Subscriber Identification Mobile SIM of the subscriber's telephone, and is used in an authentication procedure every time a subscriber requests telephone access to the system. The subscriber's IMSI is registered in the HLR of his home system together with other details about the services the subscriber is allowed. When a subscriber moves into the radio network of another system and his telephone is turned on, he is registered in the

VLR of the visited system. His IMSI is used in the registration process to interrogate his HLR to obtain his service details, and to supply location information to the HLR for forwarding incoming calls to the subscriber in the visited system. An authentication procedure is also initiated using authentication information from the AuC of the home system.

The radio network itself consists of a base station sub-system BSS comprising a base station controller BSC and several base transceiver stations BTS, each of which provides a radio cell of one or more channels. When a subscriber initiates a call, his telephone searches for a local base station so as to synchronise with a BTS and set up a route via the BSC to the MSC. The interface between the BSS and the MSC, and the links between MSCs comply with the GSM standard, and have the general features identified above.

It will be appreciated that the operators of different GSM mobile telephone systems can readily cooperate to allow roaming of their subscribers in the other systems, based on the subscribers' unique IMSIs and the common registration and authentication processes used in these systems. The links between the MSCs support the necessary control signalling and the forwarding of calls to subscribers. The operators only need to agree other operational characteristics such as the monitoring and billing of subscribers visiting/roaming from other systems.

The present invention consists in providing a radio telecommunication system in which subscribers can receive services via alternative types of radio networks, such as a direct access mobile satellite network and a terrestrial/land-based network.

According to one embodiment, the mobile telephone for a direct access mobile satellite network is adapted so that it can alternatively access a land-based GSM network using the same SIM/IMSI as when accessing the satellite network, the satellite network being designed in accordance with the same GSM standard. A subscriber to the satellite network can therefore roam on to the land-based GSM network and still be contactable on the same telephone number.

The network architecture of the switching, security management and mobility management/location management of the satellite network is provided by a GSM system comprising MSC,HLR and AuC, as shown in the accompanying drawing. The satellite system uses standard GSM HLR management procedures and protocols, and standard GSM authentication procedures. The satellite network also uses standard GSM authentication procedures.

The SIM is preferably a standard GSM SIM with standard GSM numbering structures. The satellite network uses GSM standard numbering systems with IMSIKi (IMSI personal key) and MSISDN (subscriber number) complying with GSM. The necessary network identities are compliant and registered with GSM MoU (Memorandum of Understanding) methods, so all GSM networks know the satellite network identity codes.

The satellite network operator has a roaming agreement with the GSM network. Links are provided between the MSCs of the satellite network and the GSM network. Since the satellite network MSC/HLR/AuC is a fully compliant GSM architecture, this appears to the GSM network as if it is another GSM network with the MSC acting as the gateway MSC.

The GSM network cannot "see" the different architecture beyond the interface with the radio sub-system providing the satellite radio link (i.e. the A-interface).

A subscriber to the satellite network service has a subscription registered in the satellite HLR as his home network, and the appropriate Ki is held in the satellite network AuC.

The SIM in the subscribers' mobile telephone is programmed to select the satellite network as its preferred network. When the telephone is under satellite coverage only, it registers in the satellite HLR and obtains service. When the telephone is under satellite and GSM coverage, it "sees" both networks, but selects the satellite network as its preferred network and registers on that network. The subscriber may, however, elect to join the GSM service instead, and manually selects this using a network selection function on his telephone. Since he does not subscribe to this GSM network as his home network, the GSM network enters the GSM roaming authentication and location procedure.

When the subscriber's telephone is under GSM coverage only, it uses the GSM network, and joins the network as a roaming subscriber. Should the subscriber re-enter the satellite coverage, his telephone will then automatically rejoin the satellite network, as this network is its network of choice.

If the subscriber is registered in the satellite network and an inbound call is made from the PSTN network to the satellite network, the HLR interrogation points to the satellite network VLR, and the call is handled via the satellite network MSC.

If the subscriber is registered in the GSM network, and an inbound call enters the satellite network MSC, the location procedures will set the satellite HLR entry to point to the GSM network VLR since the subscriber is registered in the VLR of the GSM network. The call is therefore routed via the inter MSC link to the GSM network.

In an alternative embodiment of the invention, the mobile telephone for a land-based GSM network is adapted so that it can alternatively access a direct access mobile satellite network using the same SIM/IMSI as when accessing the land-based GSM network, the satellite network being designed in accordance with the same GSM standard.

The subscriber to the GSM network is equipped with a dual mode telephone. His home network is the GSM network, and the GSM network is the preferred network. However, the subscriber is able to "roam" onto the satellite network in a GSM style roaming method.

It will be appreciated that in both embodiments of the invention described above, the subscriber is automatically contactable on one telephone number (his MSISDN), irrespective of whether he is on the satellite network or the GSM network.

CLAIMS

1. A radio telecommunication system, characterised in that subscribers can receive services via alternative types of radio networks.

2. A radio telecommunication system as claimed in claim 1, characterised in that the subscribers can receive services via a direct access mobile satellite network and a terrestrial network.

3. A radio telecommunication system as claimed in claim 1 or 2, characterised in that at least one subscriber can receive services via a GSM network.

4. A radio telecommunication system as claimed in claim 2 or claim 3 when dependent on claim 2, characterised in that the satellite network is operated in accordance with the GSM standard.

5. A radio telecommunication system as claimed in any one of the preceding claims, characterised in that a mobile telephone for a direct access mobile satellite network is adapted so that it can alternatively access a land-based GSM network using a same international mobile subscriber identity as when accessing a satellite network, the satellite network being designed in accordance with the same GSM standard.

6. A telecommunication system as claimed in claim 4 and 5, characterised in that the satellite network has a switching, security management and mobility/location management system provided by a GSM system comprising a GSM, HLR and AuC.

7. A telecommunication system as claimed in any one of the preceding claims, characterised in that each telephone has a subscriber identification mobile (SIM) in accordance with standard GSM numbering structures.

8. A telecommunication system as claimed in claim 7 when dependent on claim 2 or claim 5, characterised in that satellite network uses standard GSM numbering systems with an international mobile subscriber identity personal key and a subscriber number complying with GSM standards.

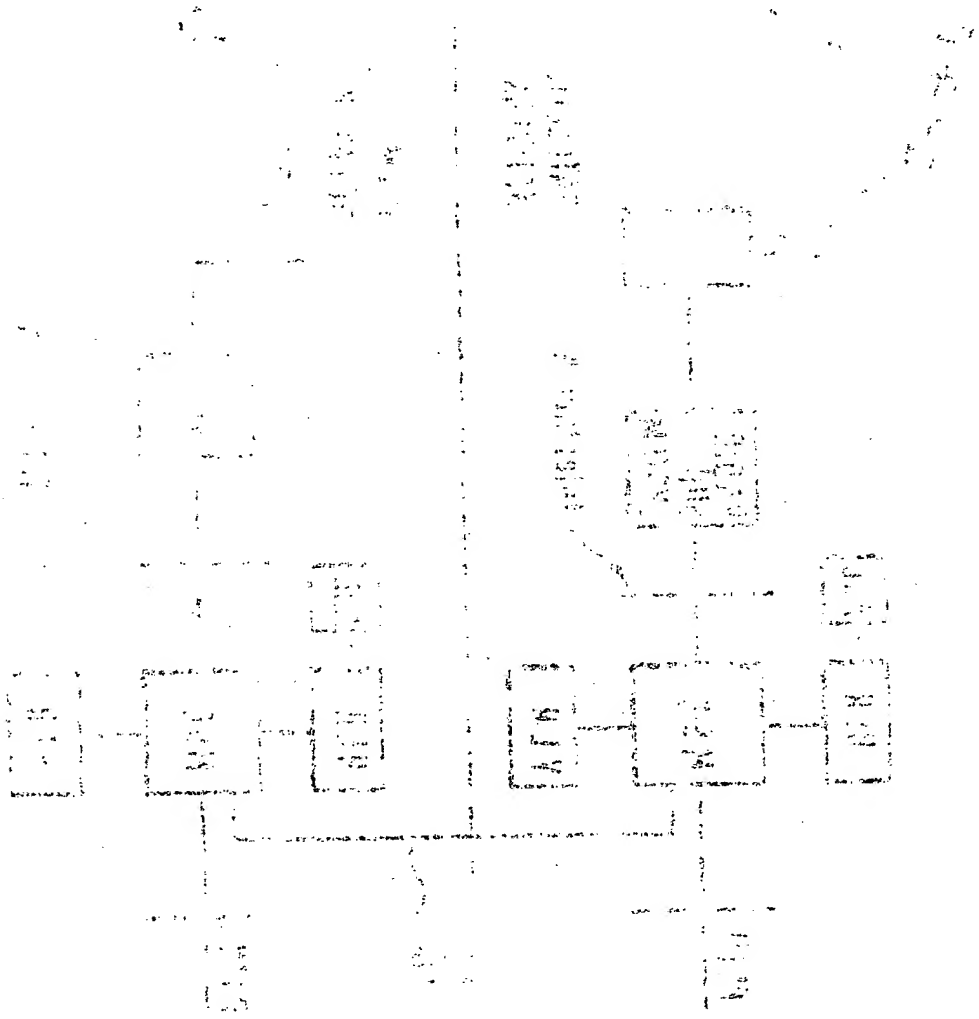
9. A telecommunication system as claimed in any one of the preceding claims in which a subscriber can roam between a satellite network and a terrestrial GSM network.

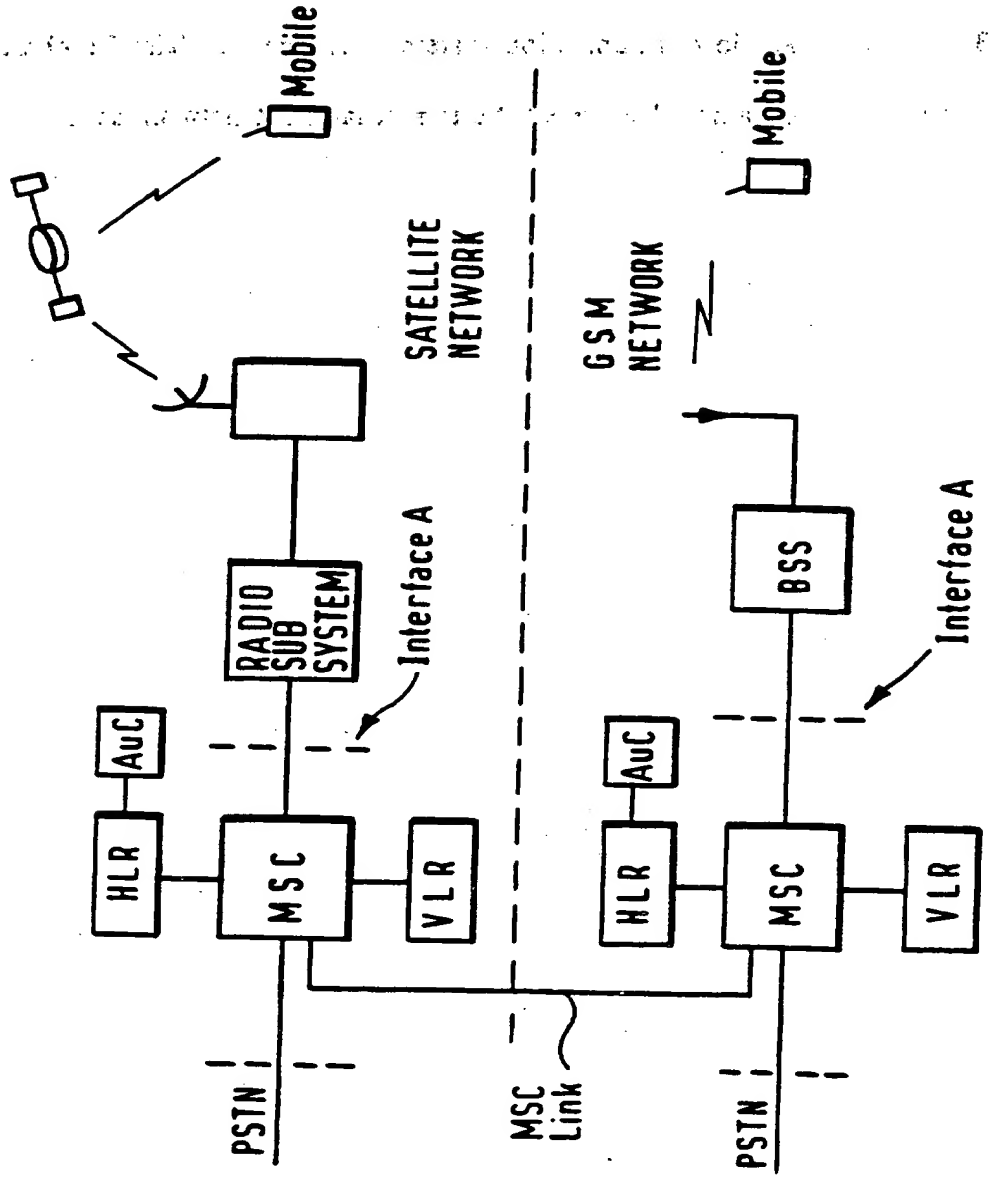
10. A telecommunication system as claimed in any one of the preceding claims, characterised in that a subscriber's mobile telephone is programmed to select a satellite network as its preferred network and in that the telephone will register with a terrestrial network when only the terrestrial network is available.

11. A telecommunication system as claimed in claim 10, characterised in that the telephone is manually controllable to select either a satellite network or a terrestrial network.

12. A telecommunication system as claimed in any one of claims 1 to 9, characterised in that a subscriber's mobile telephone for a terrestrial network is adapted so that it can alternatively access a direct access mobile satellite network using a same international mobile subscriber identity as when accessing the terrestrial GSM network, the satellite network being designed in accordance with the same GSM standard.

13. A telecommunication system as claimed in claim 12, characterised in that the telephone is programmed to select the terrestrial GSM network as its preferred network.





INTERNATIONAL SEARCH REPORT

International Application No
PCT/GB 96/00986

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H04Q7/24 H04B7/185

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 H04Q H04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	COMMUTATION ET TRANSMISSION, vol. 15, 1 January 1993, pages 109-121, XP000396196 CHARBONNIER A ET AL: "PERSPECTIVES FOR MOBILE COMMUNICATIONS" see page 111, middle column, line 10 - page 112, left-hand column, line 38 see page 113, left-hand column, line 1 - right-hand column, line 6 see page 117, middle column, line 26 - page 119, left-hand column, line 31 see page 119, right-hand column, line 1 - page 120, left-hand column, line 20; figures	1-13

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[X] Further documents are listed in the continuation of box C.

[ ] Patent family members are listed in annex.

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	IEEE PERSONAL COMMUNICATIONS, vol. 2, no. 1, 1 February 1995, pages 60-63, XP000489281 DUPUIS P: "A EUROPEAN VIEW ON THE TRANSITION PATH TOWARD ADVANCED MOBILE SYSTEMS A SMOOTH EVOLUTIONARY TRANSITION FROM GSM TO FPLMTS"	1-13
A	see the whole document	4-13
X	ELECTRICAL COMMUNICATION, 1 January 1993, pages 84-90, XP000360413 ROUFFET D: "GLOBALSTAR: A TRANSPARENT SYSTEM" see page 85, left-hand column, line 37 - page 86, left-hand column, line 10; table 2 see page 88, left-hand column, line 5 - page 90, left-hand column, line 2; figures 2,5,6	1-6,8-13
X	PROCEEDINGS OF THE VEHICULAR TECHNOLOGY CONFERENCE, STOCKHOLM, JUNE 8 - 10, 1994, vol. 1, 8 June 1994; INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, pages 321-324, XP000496687 MCFARLANE D A: "INTEGRATION OF SATELLITE SYSTEMS AND SERVICES WITHIN THIRD GENERATION MOBILE SYSTEMS SUCH AS UMTS AND FPLMTS" see the whole document	1-6,8-13
X	PROCEEDINGS OF THE THIRD INTERNATIONAL MOBILE SATELLITE CONFERENC E, JUNE 16-18, 1993, PASEDENA, CA, US, 1 January 1993, pages 149-154, XP000524011 BARANOWSKY P W: "MSAT AND CELLULAR HYBRID NETWORKING" see the whole document	1-4,6, 9-11
X	ALTA FREQUENZA, vol. 5, no. 5, 1 September 1994, pages 91-99, XP000470682 PRISCOLI DELLI F: "ARCHITECTURE OF ON INTEGRATED GSM-SATELLITE SYSTEM" see paragraph 1 - paragraph 2.1 see paragraph 3 - paragraph 3.2.2	1-4,6, 9-11

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